

RAW MATERIALS

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KAOLIN FROM ZHURAVLINYI LOG DEPOSIT FOR CERAMIC PRODUCTION

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A kaolin concentrate is proposed for various sectors of the industry, including the ceramic sector. The company takes extensive measures to stabilize the technological properties of kaolin concentrates.

Refractoriness and chemical inertness, high dispersion and purity, a white color and a high alumina content, as well as the capacity for acquiring strength after firing and a highly extended surface — all this does not exhaust the list of properties of kaolin that determine its applications. It should be admitted that the Zhuravlinyi Log deposit equipped with an effective technology for extraction and concentration of raw materials and a system of constant quality control of finished products is virtually the only source of domestic source of concentrated kaolin. According to its characteristics, kaolin from Zhuravlinyi Log can be used in various sectors of industry.

The majority of current consumers of concentrated kaolin produced by the Plast-Rifei JSC are porcelain and ceramic factories. There have been no complains lately with respect to the quality of concentrated kaolin. The practice of using concentrated kaolin from the Zhuravlinyi Log deposit shows that its use in plastic molding does not present any problems, whereas some difficulties initially occurred in using the slip casting technology. Numerous studies of the technological properties of concentrated kaolin have been performed with respect to production of ceramics. The results of these studies were summarized, published in various journals, and circulated to all ceramic factories as practical recommendations for using kaolin.

The company is carrying out extensive work to stabilize the technological properties of kaolin concentrate. For this purpose special material extraction and storage schemes have been developed.

The extraction of raw kaolin is performed selectively without mixing it with other grades. The initial storage and homogenization of raw kaolin by grades is performed at the

intermediate warehouse located near the quarry. Next, the material is transported to the company ore yard, where stockpiles of kaolin are accumulated by grades.

The dry concentration process implies:

- a sparing regime of drying raw material that does not impair the plastic properties of concentrated kaolin;
- mechanical separation of the sand fraction from the argillaceous fraction with subsequent air classification according to particle sizes.

The concentration does not involve thinning or coagulant agents. With the dry concentration method the quality of concentrated kaolin depends only on the natural properties of raw materials.

The company has developed and strictly complies with the technological procedure of sampling to monitor the concentration of the product. A laboratory has been set up, which certifies various qualitative characteristics of both raw and concentrated kaolin. In addition to quality control of the finished products, the laboratory carries out research on the qualitative parameters of raw kaolin and its products obtained at different stages of concentration.

In the past year the Plast-Rifei laboratory together with several other laboratories at porcelain and ceramics factories has continued research on stabilizing the casting properties of kaolin. The technological properties of kaolin concentrates obtained in concentrating various grades of kaolin with different mineralogical compositions have been investigated.

At present the Zhuravlinyi Log quarry is able to selectively extract normal kaolin with K_2O content usually not higher than 0.8% and alkali kaolin containing up to 3 – 4% K_2O with the potassium modulus ($K_2O : Na_2O$) not less than 10.

The main rock-forming minerals in alkali kaolins are quartz, kaolinite, microcline, and a small quantity of sericite.

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At present there are no detailed specifications on the quality of alkali kaolins; therefore, their use in their pure form in the industry, in particular in the ceramic industry, is still restricted; however, the introduction of additives has a positive effect on the capacity of alkali kaolins for being liquefied with water glass. An increase in the content of potassium oxide in concentrated kaolin stabilizes its casting properties, whereas other quality parameters of kaolin do not change. For instance, analyzing the results of the laboratory tests that are constantly performed in acceptance of finished products, we can infer that as the potassium oxide content in kaolin concentrate grows to 1.3%, the quantity of water glass required for thinning the kaolin suspension decreases by about 30%.

The test results were summarized and used to organize storage of extracted raw kaolin, which ensures stable flow properties of concentrated kaolin, both currently and in the near future.

As a consequences of the above activities, kaolin from Zhuravlinskiy Log has taken a niche on the ceramic market in Russia and abroad.

At present concentrated kaolin intended for the production of ceramic articles is shipped to various regions of Russia and to other countries.

Since the facility for the concentration of kaolin from Zhuravlinskiy Log has been started, the company is steadily growing, and its average annual growth of finished product is 34%. In 1999 the Plast-Rifei company produced around 15 thousand tons of kaolin, including 12.5 thousand tons ceramics grades, whereas in 2004 it produced 44 thousand tons of concentrated kaolin, of which 40 thousand tons were intended for producing ceramic products, i.e., more than 95% of the total production.

After the new production of ceramic granite and propants was started, the need for concentrated kaolin grew. Therefore, Plast-Rifei decided to increase its production volume of concentrated kaolin.

The existing production line is currently being upgraded according to a design made by the Soyuznerud Research In-

stitute. All types of technological machinery have been purchased and installed.

The end of the reconstruction is planned for the first half of 2005; the total production volume will then grow to 100 thousand tons. The increased production volume is planned not to introduce the new technological line but also to improve the concentration process. The introduction of additional operations in disintegration and classification of raw kaolin will further increase the efficiency of the concentration process, i.e., will increase the extraction of the useful component and at the same time stabilize the granulometric composition of kaolin concentrates.

For the purpose of ensuring the progress of the Plast-Rifei Company, continuous surveys of mineral deposits in the Zhuravlinskiy Log region are carried out. In 2003 the company won a license for a detailed geological survey and extraction of minerals at the flanks of the deposit. In 2004 the company started investigation of new beddings of kaolin in order to refine the morphology of the useful layer and to get reliable information on the reserves, quality, and technological properties of raw materials in sufficient quantities for designing extraction and concentration facilities. In the past years holes were drilled and samples taken for studying the composition and rheological properties of kaolin. Sample industrial batches were formed to study kaolins from the new beds with respect to their concentration capacity and applicability in various sectors of industry.

The above research is carried out by the Plast-Rifei JSC together with TsNIIgeolnerud Institute (Kazan) and the Uralmekhanobr Company (Ekaterinburg); the technological properties of kaolin concentrate will be carried out at the laboratories of ceramic companies and at the Paper Research Institute. Based on preliminary results, the total increment of high-grade kaolins in Zhuravlinskiy Log will amount to 40 million tons.

Thus, kaolin from Zhuravlinskiy Log is the main source of kaolin materials in Russia for producing ceramic products.